

CLAIMS

1) Thermal diffusivity measurement method characterized in that it comprises the steps of:

- subjecting a surface region of the object (2), whose thermal diffusivity (α_m) has to be determined, to a modulated laser beam (3) or to the modulated beam of a similar heating source while providing a signal (MLS) thereof by, for example, measuring said beam and providing a signal proportional to the beam intensity, the heated spot or area (4) of the surface of the object (2) having a definitive diameter and a fixed intensity distribution profile;
- providing a signal (MTS) proportional to the temperature on the heated spot or area (4);
- determining the phase difference or phase shift between the modulated beam signal (MLS) and the resulting modulated temperature signal (MTS);
- using said determined phase difference or shift and its associated modulation frequency to work out the thermal diffusivity value (α_m) of said object (2).

2) Method according to claim 1, characterized in that at least one modulation parameter is subjected to controlled variation, preferably the frequency and in that the temperature is measured at the center of the heated spot or area.

3) Method according to claim 1 or 2, characterized in that the thermal diffusivity value (α_m) of the analysed object (2) is evaluated by comparison with at least one reference or reference sample whose thermal diffusivity value (α_r) has been determined previously by being subjected to the same measurement method in similar conditions.

4) Method according to claim 3, characterized in that the modulation frequency of the heating beam (3) is varied and the variation of the phase shift of the latter with respect to the heating source is recorded for a plurality of modulation frequencies, the value of the

thermal diffusivity being determined by measuring the shifting required to superimpose the respective curves $\Delta\varphi = F(f)$ obtained for the object (2) and a reference sample in a diagram with logarithmic frequency scale, where $\Delta\varphi$ is the phase shift and f is the modulation frequency.

5) Method according to claim 3, characterized in that the phase shift between the modulated heating beam (3) and the corresponding modulated temperature is recorded for the object (2) at a given modulation frequency (f_m), then the value of the modulating frequency (f_r) yielding the same phase shift for the reference is determined and finally the value of the thermal diffusivity (α_m) of the object (2) is computed using the formula: $(\alpha_m) = \alpha_r \times (f_m/f_r)$, the dependence of the phase shift from the modulation frequency for the reference being known or having been previously measured.

6) Method according to claim 3, characterized in that the modulation frequency (f_m) of the heating beam (3) applied to the object (2) is varied until the phase shift between the modulated heating beam (3) and the corresponding modulated temperature reaches a predetermined value obtained previously for the reference at a given modulation frequency (f_r) and that the thermal diffusivity value (α_m) of the object (2) is computed using the formula: $(\alpha_m) = (\alpha_r \times f_m)/f_r$, the dependence of the phase shift from the modulation frequency for the reference being known or having been previously measured.

7) Method according to anyone of claims 1 to 6, characterized in that the modulated beam signal (MLS) and the modulated temperature signal (MTS) are both measured, successively and possibly repetitively, by measuring path and means (5, 6), preferably the same path and means for both signals, such as for example a lock-in amplifier (5) preceded by a preamplifier (6), for example by masking alternatively the beam signal generator and the temperature signal generator.

8) Method according to anyone of claims 1 to 7, characterized in that the provided

heating beam (3') is modulated by means of an acousto-optical modulator (7), or a mechanical chopper, driven by an adjustable generator (8).

9) Method according to claims 7 and 8, characterized in that the modulated beam signal (MLS) is generated by a light sensor (9), such as a photodiode, receiving a deviated part of the beam, for example the light reflected by a lens (10) through which the modulated beam (3) is passing before striking the sample (2) and in that the temperature signal (MTS) is generated by an infrared sensor (11) receiving the radiation sent out by the heated region or spot (4) of the surface of the analysed sample and focused by an infrared lens (12).

10) System for measuring the thermal diffusivity of an object, said system comprising a laser device or a similar heating source whose beam is directed towards a region or spot on the surface of said object, characterized in that said system (1) also comprises means (7, 8) for modulating said laser or heating beam (3'), means (9, 10) for generating a signal (MLS) corresponding to said modulated laser or heating beam (3), means (11, 12) for generating a signal (MTS) corresponding to the modulated temperature of the region or spot (4) struck by the modulated beam (3) and amplifying and measuring means (5, 6) able to determine at least the phase difference or shift between the modulated beam signal (MLS) and the resulting modulated temperature signal (MTS) and possibly the thermal diffusivity value (α_m) of said object (2) based upon said phase shift and associated modulation frequency.

11) System according to claim 9, characterized in that it is adapted to perform the thermal diffusivity measurement method according to anyone of claims 1 to 8.